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Application/Control Number: 09/863,998

Page 2

Art Unit: ***

CLMPTO

CANCEL CLAIMS 1-60

Art Unit: ***

61. An image processing method comprising the steps of:
defining a region containing a pixel of interest in an
original image;

defining in a plurality of modes a pixel group comprising
a plurality of pixels containing said pixel of interest and
a pixel group comprising a plurality of pixels not overlapping
those in said former pixel group, in said region;

selecting a pixel group mode from said defined plurality
of pixel group modes which best fits a structure of said origin-
al image in said region; and

producing an image using a selected pixel value of a pixel
group containing said pixel of interest in a selected pixel
group mode, as a new pixel value for said pixel of interest.

62. The method of claim 61, further comprising the steps
of

calculating an average pixel value of said pixel group
containing said pixel of interest in said selected pixel group
mode;

calculating an average pixel value of said region; and
wherein said image is produce by using a pixel value
obtained from a weighted addition of said average pixel value
of said pixel group and said average pixel value of said region.

63. The method of claim 62, further comprising the steps

APPENDIX "A"

Art Unit: ***

of

performing a weight addition on said average pixel value of said pixel group and said average pixel value of said region; and

wherein said image is produced using a pixel value obtained from a weighted addition of said pixel value obtained from said former weighted addition and a pixel value of said pixel of interest.

64. The method of claim 63, further comprising the steps of

performing a weighted addition on said produce image and said original image.

65. The method of claim 64, wherein an adjustable weighting factor is used for the weighted addition.

66. The method of claim 62, wherein said weighted addition uses a weighting factor which is a function of a minimum value of a total sum of respective residual sums of squares of pixel values of said pixel groups, said total sum being calculated for each of said pixel group modes.

67. The method of claim 66, wherein said function is a function which makes a weight for said average pixel value of said region maximum when the minimum value and the maximum value of said total sum of residual sums of squares are equal, and reduces weight for said average pixel value of said region as a minimum value of said total sum of residual sums of squares

APPENDIX "B"

Art Unit: ***

becomes smaller with respect to maximum value.

68. The method of claim 63, wherein said weighted addition uses a weighting factor which is a function of minimum value of said total sum of residual sums of squares of pixel values of said pixel groups, said total sum being calculated for each of said pixel group modes, and variance of noise of said original image.

69. The method of claim 68, wherein said function is a function which makes a weight for pixel value obtained from said former weighted addition maximum when minimum value of said total sum of residual sums of squares divided by number of pixels in said pixel group mode is equal to said variance of noise, and reduces weight for the pixel values obtained from said former weighted addition as difference between the minimum value of said total residual sum of squares divided by number of pixels in said pixel group mode and said variance of noise becomes larger.

70. The method of claim 61, wherein said selecting a pixel group mode is performed by selecting a pixel group mode in which said total sum of residual sums of squares of pixel values of the pixel groups is minimum.

71. The method of claim 61, wherein said selecting a pixel group mode is performed by selecting a pixel group mode in which said total sum of residual sums of squares of pixel values of

APPENDIX "C"

Art Unit: ***

said pixel groups is closes to variance of n e of said original image multiplied by number of pixels in said pixel group mode.

72. The method of claim 61, wherein said region is defined in a plurality of modes.

73. The method of claim 62, wherein said region is defined in a plurality of modes.

74. The method of claim 63, wherein said region is defined in a plurality of modes.

75. The method of claim 64, wherein said region is defined in a plurality of modes.

76. An image processing apparatus comprising:

a region defining means for defining a region containing a pixel of interest in an original image;

pixel group defining means for defining in a plurality of modes a pixel group comprising a plurality of pixels containing said pixel of interest and a pixel group comprising a plurality of pixels not overlapping those in the former pixel group, in said region;

selecting means for selecting a pixel group mode from said defined plurality of pixel group modes which best fits a structure of said original image in said region; and

image producing means for producing an image using a selected pixel value of a pixel group containing said pixel of interest in a selected pixel group mode, as a new pixel value for

APPENDIX "D"

Art Unit: ***

said pixel of interest.

77. The apparatus of claim 76, further comprising:
first pixel value calculating means for calculating an average pixel value of said pixel group containing said pixel of interest in said selected pixel group mode;

said pixel value calculating means for calculating an average pixel value of said region; and wherein

said image producing means comprises means for producing an image using a pixel value obtained from a weighted addition of said average pixel value of said pixel group and said average pixel value of said region, as a new pixel value for said pixel of interest.

78. The apparatus of claim 77, further comprising:

first addition means for performing a weighted addition on said average pixel value of said pixel group and said average pixel value of said region; and wherein

said image producing means comprises means for producing an image using a pixel value obtained from a weighted addition of said pixel value obtained from said former weighted addition and a pixel value of said pixel of interest, as a new pixel value of interest.

79. The apparatus of claim 78, wherein

said image producing means comprises means for producing an image using a pixel value obtained from a weighted addition

APPENDIX "E"

Art Unit: ***

of said pixel value obtained from said former weighted addition and a pixel value of said pixel of interest, as a new pixel value for said pixel of interest; and further comprising:

second addition means for performing a weighted addition on said produced image and said original image.

80. The apparatus of claim 79, wherein said weighted addition uses an adjustable weighting factor.

81. The apparatus of claim 77, wherein said weighted addition uses a weighting factor which is a function of a minimum value of a total sum of respective residual sums of squares of pixel values of said pixel groups, said total sum being calculated for each of said pixel group modes.

82. The apparatus of claim 81, wherein said function is a function which makes a weight for said average pixel value of said region maximum when minimum value and maximum value of said total sum of residual sums of squares are equal, and reduces weight for said average pixel value of said region as a minimum value of said total sum of residual sums of squares becomes smaller with respect to maximum value.

83. The apparatus of claim 78, wherein said weighted addition uses a weighting factor which is a function of minimum value of said total sum of residual sums of squares of pixel values of said pixel groups, said total sum being calculated for each of said pixel group modes, and variance of noise of said origi-

APPENDIX "F"

Art Unit: ***

inal image.

84. The apparatus of claim 83, wherein said function is a function which makes a weight for pixel value obtained from said former weighted addition maximum when minimum value of said total sum of residual sums of squares divided by number of pixels in said pixel group mode is equal to said variance of noise and reduces weight for said pixel values obtained from said former weighted addition as difference between said minimum value of said total residual sum of squares divided by number of pixels in said pixel group mode and said variance of noise becomes larger.

85. The apparatus of claim 76, wherein said selecting means comprises means for selecting a pixel group mode in which a total sum of residual squares of pixel values of said pixel groups is minimum.

86. The apparatus of claim 76, wherein said selecting means comprises means for selecting a pixel group mode in which said total sum of residual sums of squares of pixel values of said pixel groups is closes to variance of noise of said original image multipleid by number of pixels in said pixel group mode.

87. The apparatus of claim 76, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

APPENDIX "G"

Art Unit: ***

88. The apparatus of claim 77, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

89. The apparatus of claim 78, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

90. The apparatus of claim 79, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

90. The apparatus of claim 79, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

91. A recording medium which records in a computer readable manner a program for a computer to perform the functions of:

defining a region containing a pixel of interest in an original image;

defining in a plurality of modes a pixel group comprising a plurality of pixels containing said pixel of interest and a pixel group comprising a plurality of pixels not overlapping those in the former group, in said region;

selecting a pixel group mode from said defined plurality of pixel group modes which best fits a structure of said original image in said region; and

producing an image using a selected pixel value of a pixel

Appendix "H"

Art Unit: ***

group containing said pixel of interest in a selected pixel group mode, as a new pixel value for said pixel of interest.

92. The recording medium of claim 91, which records in a computer readable manner a program for a computer to perform the further functions of

calculating an average pixel value of said pixel group containing said pixel of interest in said selected pixel group mode;

calculating an average pixel value of said region; and

wherein said image is produced by using a pixel value obtained from a weighted addition of said average pixel value of said pixel group and said average pixel value of said region, as a new pixel value for said pixel of interest.

93. The recording medium of claim 92 which records in a computer readable manner a program for a computer to perform the further functions of performing a weighted addition on said average pixel value of said pixel group and said average pixel value of said region; and wherein said image is produced by using a pixel value obtained from a weighted addition of said pixel value obtained from said former weighted addition and a pixel value of said pixel of interest, as a new pixel value of said pixel of interest.

94. The recording medium of claim 93 which records in a computer readable manner a program for a computer to perform

APPENDIX "I"

Art Unit: ***

further functions of

performing a weighted addition on said produced image and said original image.

95. The recording medium of claim 91 which records in a computer readable manner a program for a computer to perform the further functions, wherein said region is defined in a plurality of modes.

96. The recording medium of claim 92 which records in a computer readable manner a program for a computer to perform the further functions, wherein said region is defined in a plurality of modes.

97. The recording medium of claim 93 which records in a computer readable manner a program for a computer to perform the further functions, wherein said region is defined in a plurality of modes.

98. The recording medium of claim 94 which records in a computer readable manner a program for a computer to perform the further functions, wherein said region is defined in a plurality of modes.

99. An imaging apparatus comprising:

a signal collecting means for collecting a signal from an object;

an original image producing means for producing an original image based on said collected signal;

APPENDIX "J"

Art Unit: ***

a region defining means for defining a region containing a pixel of interest in said original image;

pixel group defining means for defining in a plurality of modes a pixel group comprising a plurality of pixels containing said pixel of interest and a pixel group comprising a plurality of pixels not overlapping those in said former pixel group, in said region;

selecting means for selecting a pixel group mode from said defined plurality of pixel group modes which best fits a structure of said original image in said region; and

image producing means for producing an image using an average pixel value of said pixel group containing said pixel of interest in said selected pixel group mode, as a new pixel value for said pixel of interest.

100. The apparatus of claim 99, further comprising

first pixel value calculating means for calculating an average pixel value of said pixel group containing said pixel of interest in said selected pixel group mode;

second pixel value calculating means for calculating an average pixel value of said region; wherein said

image producing means comprises means for producing a pixel value obtained from a weighted addition of said average pixel value of said pixel group and said average pixel value of said region, as a new pixel value for said pixel of interest.

APPENDIX "K"

Art Unit: ***

101. The apparatus of claim 100, further comprising:

first addition means for performing a weighted addition on said average pixel value of said pixel group and said average pixel value of said region; and wherein

said image producing means comprises means for producing an image using a pixel value obtained from a weighted addition of said pixel value obtained from said former weighted addition and a pixel value of said pixel of interest, as a new pixel value for said pixel of interest.

102. The apparatus of claim 101, further comprising:

second addition means for performing a weighted addition on said produced image and said original image.

103. The apparatus of claim 99, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

104. The apparatus of claim 100, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

105. The apparatus of claim 101, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.

APPENDIX "L"

Art Unit: ***

106. The apparatus of claim 102, wherein said region defining means comprises means for defining in a plurality of modes a region containing a pixel of interest in an original image.